



SYNTHESIS OF NATIONAL EFFORTS IN TRANSPORTATION ASSET MANAGEMENT

Project 01 – 01
May 2002

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NOTES FROM THE RESEARCHERS

In the Fall of 2001, the Midwest Regional University Transportation Center (University of Wisconsin, Madison) conducted a survey of national efforts in Transportation Asset Management. The organizations and efforts described herein are for illustrative purposes only and the survey was not intended to be comprehensive. The results show a wide breadth of interest and research in the area of transportation infrastructure management, which is generally not apparent to many who are new to this field.

Therefore, the report is intended to target a general audience that is interested in Asset Management and how various organizations are approaching the concept. Transportation professionals, officials, and researchers who are relatively unfamiliar with this area of infrastructure management may find this report helpful by introducing them to various past and present efforts.

Disclaimer:

This research was funded by the Midwest Regional University Transportation Center, the Wisconsin Department of Transportation and the Federal Highway Administration under Project #0092-01-10. The contents of this report reflect the views of the authors who are responsible for the facts and the accuracy of the information presented herein. The contents do not necessarily reflect the official views of the Midwest Regional University Transportation Center, the University of Wisconsin, the Wisconsin Department of Transportation, or the Federal Highway Administration at the time of publication.

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ACKNOWLEDGEMENTS

The Midwest Regional University Transportation Center would like to thank those national organizations that responded to our survey and provided critical information. Our thanks to the Wisconsin DOT and the University Transportation Center program through the Office of Innovation, Research and Education, Research and Special Programs Administration, US DOT for their support. In addition, we appreciate the efforts of Tim Lomax (Texas Transportation Institute), Sue McNeil (Urban Transportation Center, University of Illinois – Chicago), and Dave Ekern (American Association of State Highway and Transportation Officials) in offering advice and comment throughout our research effort.

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ACRONYM DECODER

Agencies and Government Institutions

Federal Highway Administration (FHWA)
Federal Rail Administration (FRA)
Federal Transit Administration (FTA)
Local Technical Assistance Program (LTAP)
National Highway Institute (NHI)

Professional Organizations

American Concrete Pavement Association (ACPA)
American Public Works Association (APWA)
American Road and Transportation Builders Association (ARTBA)
American Public Transportation Association (APTA)
American Society of Civil Engineers (ASCE) & Civil Engineering Research Foundation (CERF)
Foundation for Pavement Preservation (FP²)
Governmental Accounting Standards Board (GASB)
National Association of County Engineers (NACE)
Transportation Research Board (TRB)

Educational Organizations

Midwest Regional University Transportation Center (MRUTC) – University of Wisconsin, Madison
Midwest Transportation Consortium (MTC) and the Center for Transportation Research and Education (CTRE) – Iowa State University
Urban Transportation Center (UTC) – University of Illinois, Chicago
University Transportation Research Center (UTRC) – City College of New York

International Organizations

Federation of Canadian Municipalities (FCM)
National Research Council of Canada (NRCC)
World Road Federation (PIARC)
Organization for Economic and Cooperative Development (OECD)
World Bank & the International Road Federation (IRF)

Other Acronyms

Highway Development and Management model (HDM)

SYNTHESIS OF NATIONAL EFFORTS IN TRANSPORTATION ASSET MANAGEMENT

A Study by the Midwest Regional University Transportation Center¹

Spring 2002

Purpose: This project identifies several national efforts active today in Asset Management and provides information on their latest activities designed to help state and local governments implement long-term management strategies.

SURVEY OF NATIONAL EFFORTS

Organizations Introducing Asset Management

Organizations are using several methods to introduce Asset Management to a wide audience. In addition to the “primers” developed by FHWA and the initial meetings held by AAHSTO from 1996 to 1999, several other efforts have occurred or are occurring:

Conferences and Meetings:	
<i>MRUTC</i>	“4 th National Transportation Asset Management Workshop – Taking the Next Step in Asset Management” (September 2001)
<i>IRF</i>	“Executive Seminar on Asset Management” (November 2001)
Committees:	
<i>AASHTO</i>	Task Force on Transportation Asset Management
<i>TRB</i>	Asset Management Task Force
<i>NRCC</i>	Advisory Committees associated with the National Guide to Sustainable Municipal Infrastructure project
<i>PIARC</i>	Road Management Committee

Organizations with Educational and Research Efforts

Several educational and research efforts explore the implementation of Asset Management systems from a policy and technical perspective. The national groups involved in this area are:

Course Development and Training:	
Educational Institutions <i>MRUTC, MTC, UC, UTC, UTRC</i>	Course development in transportation infrastructure management. Efforts to develop Master’s level transportation management degrees.
Professional Organizations <i>AASHTO, APWA, GASB</i>	Training opportunities in GASB Statement 34 implementation.
Technology Transfer <i>LTAP, FP², NHI</i>	Training opportunities in Asset Management systems, pavement management, and bridge management.
Policy Research:	
<i>NCHRP & AASHTO Task Force on Transportation Asset Management</i>	Developing a policy framework to implement Asset Management systems (NCHRP Project SP20-24[11] – the Asset Management Guide).
<i>TRB Asset Management Task Force</i>	Designing a research agenda to investigate implementation of Asset Management.
Educational Institutions <i>MRUTC, MTC, UC, UTC, UTRC</i>	Sponsoring research in strategic planning, decision-making frameworks, and the barriers to agency cooperation in management issues.
<i>OECD</i>	Surveyed international efforts implementing Asset Management.

AASHTO: American Assoc. of State Hwy & Trans. Officials
ACPA: American Concrete Pavement Assoc.
APWA: American Public Works Assoc.
ASCE & CERF: American Society of Civil Engineers & Civil Engineering Research Found.
FHWA: Federal Hwy. Admin.
FP²: Foundation for Pavement Preservation
GASB: Governmental Accounting Standards Board
IRF: International Road Federation
LTAP: Local Technical Assistance Program
MRUTC: Midwest Regional Univ. Trans. Center
MTC: Midwest Trans. Consortium
NCHRP: National Coop. Hwy. Research Program
NHI: National Hwy. Institute
NRCC: National Research Council of Canada
PIARC: World Road Federation
OECD: Organization for Econ. & Coop. Development
TRB: Trans. Research Board
UC: Univ. of Cincinnati
UTC: Urban Trans. Center
UTRC: Univ. Trans. Research Center

¹ Authors: Bill Obermann, Ernie Wittwer, & Jason Bittner – Midwest Regional University Transportation Center. Principal Investigator: Jeffrey Russell, Professor, Department of Civil and Environmental Engineering, University of Wisconsin, Madison.

Technical Research:	
<i>NCHRP & AASHTO</i>	Developing economic modeling, performance measurement, and valuation methods for transportation assets (NCHRP Projects SP20-24[11] & 20-57)
<i>Educational Institutions MRUTC, MTC, UTC, UTRC</i>	Investigating the use of modeling, GIS, and innovations in transportation technology to manage systems more efficiently.
<i>FP²</i>	Examining improved techniques for construction and preservation.
<i>ASCE/CERF</i>	Evaluating research products in transportation management.
<i>ACPA</i>	Developing remaining service life and life cycle cost models.
<i>PIARC and IRF</i>	Continuing to refine the economic investment model HDM (the Highway Development and Management model).

Organizations Assisting with Institutional Change

Relatively few organizations are working on the issue of managing the organizational change necessary to develop Asset Management systems. Several organizations recognize this field as a research priority, but so far only the following products are available:

<i>Utah LTAP</i>	Applied courses and consulting with agencies to phase in the components of Asset Management systems.
<i>FHWA, FP², NHI</i>	Discussion of research needed in implementation and institutional change at the 1998 Forum to the Future.
<i>Rudin Center for Transportation Policy and Management</i>	Study on the implementation of Asset Management concepts in the traffic management departments of several large cities.

CONCLUSIONS AND RESEARCH NEEDS

Several groups surveyed have developed research agendas in transportation infrastructure management. These groups are working to fill the policy and technical research gaps that hinder Asset Management implementation. At the same time, most groups are also developing research agendas that will explore implementation issues and future education/training needs. As these groups develop this future research, several conclusions from this project should be emphasized:

- **Duplication of Research Efforts and Need for Collaboration:** All of the groups in the survey have at least an awareness of Asset Management. This is raising interest for further research and many organizations are responding by developing studies on a variety of policy and technical topics. However, as these efforts occur, little collaboration and information sharing takes place. Projects need to emphasize working together to develop research and results, which will also maximize recognition and implementation.
- **Conservation and Community Focus:** Some international efforts in Asset Management consider conservation and community goals along with the engineering aspects of infrastructure management. As concerns over funding and mobility issues grow in the US, future research should develop frameworks and tools that detail how Asset Management systems can address community and conservation goals.
- **Interdisciplinary Focus:** Asset Management is a blend of engineering, management, reorganization, and planning. Any future education and training should emphasize this interdisciplinary reality. Some universities are developing interdisciplinary transportation management and policy Master's degrees.
- **Communication and Leadership:** Defining and communicating the importance of Asset Management is still necessary. National organizations could be more effective in communicating these issues. The groups could also assist agencies to empower managers and other leaders in promoting Asset Management among personnel.

INTRODUCTION

What is Transportation Asset Management and why do we need it?

Transportation agencies on the federal, state, and local levels have recognized the need to manage infrastructure under tightly constrained budgets. In addition, these agencies are not only responsible for construction of infrastructure, but also the maintenance, operation, safety, and other aspects of management. Transportation Asset Management is a systematic process to consider these areas and ensure attainment of the goals of the agency.²

Why Asset Management?

Transportation agencies have a range of responsibilities in managing infrastructure, such as construction, maintenance, operation, safety, and various other aspects. *Asset Management* is a concept recognizing the need to manage across these areas of responsibility.

Asset Management is:

The assimilation of data and analytic tools together with systematic implementation processes to ensure attainment of agency goals.

The history of infrastructure management and key drivers influencing change

Among the key elements that can help shift focus to an Asset Management perspective is funding allocation. During conception of the interstate highway system, the Highway Trust Fund of 1956 was developed to fund construction. Many transportation agencies at the local and state level recognized the management needs of the system and developed excellent data collection systems, GIS capacities, and even performance measurement techniques to maintain what they had constructed. Federal legislation also acknowledged the need to emphasize infrastructure management through the 1991 Intermodal Surface Transportation Efficiency Act (ISTEA). ISTEA gave greater flexibility of Highway Trust Fund monies and required the establishment of management systems for roads, bridges, tunnels, public transportation and other transportation assets.³ ISTEA also acknowledged the need for system-wide decision-making tools, and initiated research implementing these systems.

Today, the Transportation Equity Act for the 21st Century (TEA-21) maintains the original goals of ISTEA. Asset Management concepts remain an important component of these goals, however, most state and local transportation agencies have not moved far in implementation. They are actively seeking advice and research on Asset Management from federal agencies and other national and international organizations.

² An additional source of information about Asset Management is the Primer on Asset Management, developed by the Federal Highway Administration, Office of Asset Management and available at: www.fhwa.dot.gov/infrastructure/asstmgmt/resource.htm (valid as of: 02/04/02).

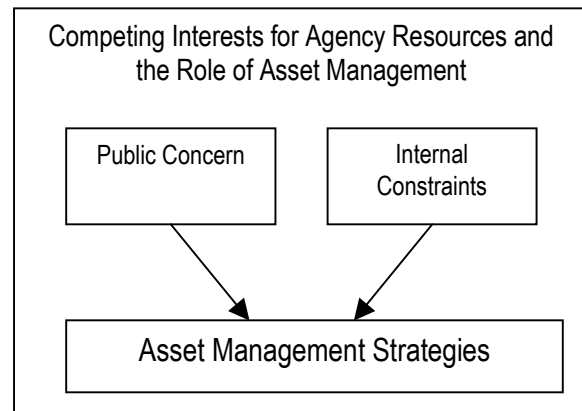
³ The National Highway System Designation Act of 1995 made these management systems optional for states to adopt. Implementation efforts as of 1997 are summarized in "Transportation Infrastructure: States' Implementation of Transportation Management Systems" (GAO Report # T-RCED-97-79: February 26, 1997).

Project Purpose: To Raise Awareness of National Efforts in Transportation Asset Management

This project identifies several national efforts active today in Asset Management and provides information on their latest activities designed to help state and local governments implement long-term management strategies.

Why is this project important?

As people become more educated about government finance and the condition of transportation infrastructure, they expect government to adopt improved management systems. In addition, the typical driver encounters a number of managed attributes during an average trip, such as pavement roughness, inadequate signage, signalization, and congestion. Agencies are responsible for maintaining these roadway assets. The need to improve or maintain service levels lends directly to the adoption of the Asset Management strategies national groups are helping develop.



GASB 34: Component of a Future Asset Management Strategy?

Asset Management is gaining awareness in many governmental agencies due to the Governmental Accounting Standards Board (GASB) Statement 34. If an agency chooses to adopt the "modified approach" in Statement 34, they will detail annual spending on maintenance and preservation efforts, as well as the overall value of the transportation asset.⁴ Currently, most DOT expenditure summaries do not report these costs. A potential benefit of the more detailed GASB 34 reports could be to raise public awareness on the stewardship activities of federal, state, and local DOTs.

GASB 34 is not a stand-alone solution to the infrastructure management problem, but it is certainly a component of the rapidly evolving Asset Management methodology. Several national agencies and organizations contributed to the development of Statement 34's methodology, and many more are currently engaged in training local officials how to use it.

Federal Programs in Asset Management

Some federal agencies, such as the Federal Highway Administration's (FHWA) Office of Asset Management and the FHWA's own Local Technical Assistance Program (LTAP) recognize the importance of Asset Management and are introducing the concept to their agencies and constituents. Other agencies such as the Federal Transit Administration (FTA) and Federal Rail

⁴ For more information on the modified approach and other approaches that can be used with Statement 34, see the following website available through the GASB organization: <http://www.gasb.org/repmodel/index.html> (valid as of: 03/18/02).

Administration (FRA) are just beginning to recognize the concept and how it will be important for their agencies.

Other National Programs

Outside of the federal agencies, many other organizations are also working to promote Asset Management systems and their components. From research efforts in the National Cooperative Highway Research Program (NCHRP) and the Midwest Regional University Transportation Center (MRUTC) to awareness building efforts through the American Public Works Association (APWA), many groups participate in developing Asset Management tools and policies. This list goes beyond some of the familiar groups commonly associated as working on a national level in Asset Management. In some cases, these groups may not use the phrase “Asset Management” to describe their work, but they are advocating for integrated decision-making across disciplines and each have efforts worth recognition.

Groups Developing Asset Management tools and strategies:

Not only AASHTO, FHWA, FTA, and FRA but also:

ACPA, APWA, ASCE, ARTBA, APTA, FP², GASB, NCHRP, MTC, MRUTC, NACE, OECD, PIARC, TRB, UC, UTC, UTRC, World Bank, and several Canadian organizations.

(See the Acronym Directory for explanation of these acronyms)

The intent of this report is to explore these national and international efforts, the well known and the less known, and bring their contributions to the forefront. These efforts are discussed and conclusions drawn where the survey results demonstrated gaps in current knowledge and research. The conclusion of this report will include recommendations for future work and potential areas for collaboration between groups with similar interests. In addition, a summary of each national effort researched is included in the Appendix.

NATIONAL EFFORTS IN TRANSPORTATION ASSET MANAGEMENT

National organizations with an interest in Asset Management are generally working in the following areas:

1. Introduction to the Concept: Introducing Asset Management to agency staff or wider, non-technical audiences.
2. Education: Specific education or training activities that embody the concepts of Asset Management, including curriculum or executive course development.
3. Research in Policy and Technical Issues: Development of guidance to implement technical, economic, and social policies in Asset Management. In addition, research efforts in data integration, economic and life-cycle analysis, and other technical issues related to transportation infrastructure management.
4. Institutional Change: Facilitating implementation of Asset Management in all levels of the organization.

Not every effort has an activity in each of these areas, but instead focuses on the elements within their expertise. For example, the American Road and Transportation Builders Association (ARTBA) is a national organization that represents the interests of the transportation construction industry. Their aims are clearly in the policy area of Asset Management and they advocate for improved programs in “consistent and timely maintenance” as well as researching new ways to optimize programs in maintenance, operations, and safety with the federal portion of state Department of Transportation budgets.⁵ Each organization has unique perspectives to contribute to Asset Management in the United States. Recognizing these efforts and that they should be integrated into the development of Asset Management systems is the goal of this report. The authors do not intend to identify who would be the best in each role or function. The intention of this research is to identify these groups and initiate dialogue about potential resource sharing and collaboration.

1. Introduction to the Concept of Asset Management

Federal Highway Administration

Several well-known organizations produce introductory material about Asset Management. Perhaps the most widely recognized is the Federal Highway Administration (FHWA) Office of Asset Management. This Office was formed during the 1998 restructuring of the US Department of Transportation into five core “business units” to realign the Department with a revised mission

FHWA’s Efforts in Asset Management: (Office of Asset Management)

⚙ Educational Assistance:

- Primers: *Asset Management*, *GASB 34*, *Data Integration*, *Pavement Management*

- Website
- Workshops and Conferences

⚙ Technical Assistance:

- Development of pavement, bridge, and tunnel management systems.
- Development of economic trade-off analysis tools.
- Guidance on quality construction and management.

⁵ “America’s Roadway Operations: Improving Capacity and Efficiency” American Road and Transportation Builders Association (ARTBA), October, 2001 http://www.artba.org/government/tea-21/tea_21.htm (valid as of: 02/04/02).

and strategic goals. As transportation management issues continue to evolve, even within FHWA, the Office has found a useful role offering educational and technical assistance.

The Office widely distributes educational materials in the form of “primers” on certain topics. To date, primers introduce the concept of Asset Management itself, as well as topics like GASB 34, data integration, and pavement management systems. These materials are not technical guidance with a step-by-step process to implement these concepts, but instead serve to increase awareness over a wide audience on the issues.

Other areas of technical expertise the Office offers are in pavement, bridge, and tunnel management systems and the development of economic trade-off analysis tools. The Office also offers technical advice on roadway construction and pavement design with a long-term preventive maintenance perspective. States and local government can participate as they design and maintain their own infrastructure.

American Association of State Highway and Transportation Officials

The American Association of State Highway and Transportation Officials (AASHTO) Task Force on Transportation Asset Management is also working on Asset Management awareness and implementation. The Task Force has developed a Strategic Plan with goals of integrating investment decisions in improvement, preservation, and operation of transportation facilities. Some of the strategies in the Plan are currently underway, such as the development of an Asset Management Guide (sponsored through the National Cooperative Highway Research Program (NCHRP) as Project SP20-24[11]) that will outline how to implement an Asset Management system. AASHTO also sponsored many of the initial Workshops and Seminars introducing the concept of Asset Management and is still very active in such efforts today.

AASHTO and FHWA have undertaken efforts to create an awareness of Asset Management on a national scale, but they are not the only ones doing such work. Within the general recognition of improved transportation management concepts, many organizations with a specialization in technical outreach, training, and education have developed programs or research in Asset Management to foster awareness in their constituents. The table below details the organizations studied and the concentrations of their efforts.

TABLE 1.1
Organizations actively participating to raise awareness of
Asset Management concepts (other than AASHTO and FHWA)*

	Committees	Conferences & Meetings	Publications & Presentations
Professional Organizations & Government Agencies			
ACPA (American Concrete Pavement Association)			X
APTA (American Public Transportation Association)		X	
APWA (American Public Works Association)	X	X	X
ARTBA (American Road and Transportation Builders Association)			X

	Committees	Conferences & Meetings	Publications & Presentations
Professional Organizations & Government Agencies (cont.)			
ASCE & CERF (American Society of Civil Engineers & the Civil Engineering Research Foundation)	X	X	X
FP ² (Foundation for Pavement Preservation)		X	X
FTA (Federal Transit Administration)			X
GASB (Governmental Accounting Standards Board)		X	X
NACE (National Association of County Engineers)		X	
NCHRP (National Cooperative Highway Research Program)			X
TRB (Transportation Research Board)	X	X	X
Educational Organizations			
LTAP (Local Technical Assistance Program)		X	X
MRUTC (Midwest Regional University Transportation Center – Madison, WI)		X	X
MTC & CTRE (Midwest Transportation Consortium & the Center for Transportation Research and Engineering - Ames, IA)		X	X
UTC (University of Illinois – Chicago, Urban Transportation Center – Chicago, IL)			X
UTRC (CCNY University Transportation Research Center – New York, NY)			X
Canadian Programs			
NRCC & FCM (National Research Council of Canada & the Federation of Canadian Municipalities)	X		X
MIIP (Municipal Infrastructure Investment Planning: a group through the Institute for Research in Construction)	X		X
International Organizations			
IRF (International Roads Federation)		X	X
OECD (Organization for Economic and Cooperative Development)			X
PIARC (World Road Federation)	X	X	X

Note: The categories **Committees**, **Conferences & Meetings**, and **Publications & Presentations** are general areas where discussion of Asset Management practices has occurred. Some examples of how this exchange has taken place could be online reports, sessions at annual meetings, or specific Task Forces in Asset Management.

As this table shows, professional organizations and agencies have assumed a large responsibility for creating an awareness of Asset Management, but several educational and international organizations have also contributed significant efforts.

Past Committees

Several of these groups have convened special Committees with the charge to understand Asset Management better. Most of these Committees assembled to investigate how Asset Management pertains to the organization and how it can be useful to its constituents. Two significant past efforts are those of the American Public Works Association (APWA) and the Civil Engineering Research Foundation (CERF). Both these groups investigated Asset Management as a tool for infrastructure management in 1998. While these original efforts have ended, some discussion is still taking place today.

The APWA recognized Asset Management as an important concept for managing public works infrastructure and developed a Task Force to produce a report on the subject. The resulting paper entitled, “Asset Management for the Public Works Manager” described the theory of Asset Management as it pertains to the public works industry and developed a working definition that emphasized it as a decision-making tool to allocate resources across competing interests.⁶ In addition, the paper proposed several strategies to initiate awareness of Asset Management and addressed several implementation issues inherent in such a systems approach. Since the Task Force disbanded, the Leadership and Management Committee of APWA has several goals in its mission that specially acknowledge Asset Management as an area needed for research and development. A part of this mission also emphasizes implementation of GASB 34 through identifying and encouraging adoption of performance measurement and management tools.⁷

In 1998, a major initiative in the Civil Engineering Research Foundation (CERF) involved collaboration between the Office of Science and Technology and the US Department of Transportation on an initiative called PAIR-T (the Partnership for the Advancement of Infrastructure and its Renewal through innovative products and processes – the Transportation component). The mission of the initiative was to use technology and innovation to promote advanced management of transportation infrastructure. While several key agencies championed the effort, it is not a functioning group today. However, CERF and its parent organization, the American Society of Civil Engineers (ASCE) have incorporated several of the Asset Management components of PAIR-T into their current work. In the Summer of 2000, CERF sponsored a Workshop entitled, “Managing Infrastructure Assets” to continue a dialogue about Asset Management and further the research goals of PAIR-T. In addition, ASCE continues to hold sessions on Asset Management at its annual

National or International Committees:

Recent Past:

APWA: Asset Management Task Force (1998)

CERF: PAIR-T Initiative (1998)

Current:

AASHTO: Task Force on Transportation Asset Management

TRB: Asset Management Task Force

NRCC: Technical and Steering Committees associated with development of the National Guide to Sustainable Municipal Infrastructure

PIARC: Road Management Committee

Note: See the Acronym Directory for explanation of these acronyms.

⁶ American Public Works Association (1998) *Asset Management for the Public Works Manager: Challenges and Strategies* <http://www.apwa.net/ResourceCenter> (valid as of: 02/04/02).

⁷ American Public Works Association (2001) *Leadership and Management 2001 Business Plan* www.apwa.net/About/PET/Leadership/index.asp?mode=businessplan (valid as of: 10/3/01).

conferences and addresses the need for better management tools in its “2001 Report Card on America’s Infrastructure”.⁸

Current Committees

The Transportation Research Board (TRB) Asset Management Task Force is a relatively new effort addressing upcoming research needs in Asset Management, especially in the area of implementation. The Task Force has recognized several key issues that DOTs face when developing these systems, such as how to conduct trade-off analyses and determine level of service.

TRB has several other committees that have an interest in Asset Management concepts. Some examples are the Committee on Strategic Management, the Committee on Pavement Management Systems, the Committee on Structures Maintenance and Management, and the Committee on Statewide Multi-modal Transportation Planning.

Canada also has a number of committees and groups that concentrate on raising awareness of Asset Management. Through the National Research Council of Canada (NRCC) and the Federation of Canadian Municipalities (FCM) several committees are dedicated to the development of a National Guide to Sustainable Municipal Infrastructure (a \$25 million project to develop a decision-making and investment-planning tool and an appendix of best practices). In addition, several Canadian organizations are developing committees on Asset Management projects, such as the Strategic Asset Management Project within the Institute for Research in Construction (IRC), Municipal Infrastructure Investment Planning (MIIP) Group. The committees’ research goals are to evaluate the tools and techniques currently available to assist municipal asset managers and develop recommendations about the tools required if managers are to make integrated management decisions. As in the United States, several significant committees also meet on the local and state (provincial) level to discuss Asset Management implementation, especially with respect to data integration and technical tool development.

Another international example is the World Road Federation (PIARC), which has a permanent committee to discuss road management and implementation of concepts like Asset Management. The Road Management Committee specifically addresses Asset Management as a necessary tool to promote efficient and economical government expenditures. A priority in the Committee is to track implementation of research developed within PIARC, especially the Highway Development and Management System, which is a highway investment analysis program known as HDM-4 (see the Appendix for a more detailed description of HDM-4).

⁸ American Society of Civil Engineers (2001) *The ASCE Report Card on America’s Infrastructure* www.asce.org/reportcard/index.cfm?reaction=policy (valid as of: 10/11/01).

Conferences, Workshops and Meetings

As shown in Table 1.1, many groups raise awareness about Asset Management through conferences, workshops, and/or meetings. A key criterion for an organization to make this list was the sessions had to be open to the public. The term “meetings” does not imply an *internal* meeting on the subject. Instead, it is an organized setting where the constituents of these various groups were exposed to Asset Management, mostly for the first time.

Within the last year, two organizations held specific conferences or workshops with Asset Management as their main theme, one of which was a US group. The Midwest Regional University Transportation Center (MRUTC) hosted a Workshop entitled, “The Fourth National Transportation Asset Management Workshop: Taking the Next Step in Asset Management” in September 2001. Many of the US groups involved in Asset Management, such as AASHTO, APTA, APWA, FHWA, MTC, NACE, TRB, and UTC, co-sponsored the Workshop. The Workshop structure intended to bring different groups and their members together to foster information and idea sharing. Many of the sessions in the Workshop focused on publicizing the efforts of AASHTO, FHWA, and TRB in the field as well as the practical lessons learned from city, county, state, and transit agencies implementing Asset Management techniques. In addition, curriculum and course development in Asset Management received considerable attention.

The other conference recently held in Asset Management was on an international scale. This was the International Road Federation (IRF) Asset Management Seminar, held in the fall of 2001. The purpose of the Seminar was to introduce the concept of Asset Management to an international audience and identify the components and tools used around the world to implement integrated decision-making. In addition, the conference highlighted institutional issues such as effective training, communication, and benchmarking systems that require implementation on the human side of an organization. There was US interest in the Seminar and the attendees of the conference toured the Virginia DOT where an Asset Management system is in development. However, the conference did not emphasize a US perspective, but showed how other countries interpret Asset Management and implement programs in their country. Case studies from almost every continent were highlighted, including some countries that are well known for Asset Management, such as the United Kingdom, Australia, and New Zealand. In addition, the Seminar detailed efforts in Brazil, Kenya, the Philippines, Malawi, Mexico, Venezuela, Puerto Rico, and Saudi Arabia.

PIARC also sponsors a World Congress every 4 years. In 1999, the conference focused on managing road infrastructure assets. Specifically, the Congress discussed the criteria necessary to evaluate the needs of the transportation systems. This list not only included engineering and technical requirements to manage roadways, but also the social and environmental criteria.

National or International Conferences and Workshops:

- ☀ With Asset Management at the theme:
 - MRUTC: “4th National Transportation Asset Management Workshop – Taking the Next Step in Asset Management” (September 2001)
 - IRF: “Executive Seminar on Asset Management” (October 2001)
- ☀ With Sessions in Asset Management:
 - APWA, ASCE, FP², GASB, local and state LTAP groups, NACE, and TRB

Note: See the Acronym Directory for explanation of these acronyms.

Incorporated with these discussions were considerations of the responsibility of government to attain the highest community value and technology transfer for the money spent. A particularly relevant discussion with representatives from different countries gave perspective on using the Highway Development and Management System (HDM-4). A similar effort in the United States is the Highway Economic Requirements System (HERS) research developed through the FHWA Office of Legislation and Strategic Planning. Both of these efforts are developing methods to model the economic requirements of transportation infrastructure construction and management. If applicable, sharing between these groups is encouraged.

The other organizations mentioned in Table 1.1 under the “Conferences and Meetings” column held, or plan to hold, sessions in Asset Management at annual conferences or meetings. Many professional and educational organizations (specifically APWA, ASCE, FP², GASB, state and local LTAP groups, NACE, and TRB) held introductory sessions on the concept of Asset Management, the financial reporting requirements of GASB 34, or implementation issues encountered. Many of these organizations brought in staff from the FHWA Office in Asset Management, state and local officials who are actively developing Asset Management systems, and managers responsible for managing assets in the private sector (such the railroad and trucking industries).

Publications and Presentations

Almost every national group surveyed had at least one publication or presentation that introduced the concept of Asset Management. Many of these sources were online quarterly or monthly newsletters and served to define Asset Management and its relevance to the constituents of the organizations and the transportation industry as a whole. Many presentations were given at annual conferences or meetings sponsored by professional, educational, and international organizations. A partial list of each organization’s specific publications and presentations is in the Appendix.

2. Educational Efforts in Asset Management

Several of the organizations surveyed also have educational efforts in Asset Management. These efforts range from course and curriculum development to technical training courses in roadway management. Within these different forms, groups are educating individuals on a range of issues, from the specifics of GASB 34 compliance to a general introduction on the concepts of Asset Management. Table 2.1 below details what groups have some form of educational efforts.

TABLE 2.1
Educational Efforts in Asset Management

	Course Development	Technical Training
Professional Organizations & Agencies		
AASHTO (American Association of State Highway and Transportation Officials)		X
APWA (American Public Works Association)		X

	Course Development	Technical Training
Professional Organizations & Agencies (cont.)		
FHWA (Federal Highway Administration)		X
FP ² (Foundation for Pavement Preservation)		X
GASB (Governmental Accounting Standards Board)		X
Educational Organizations		
LTAP (Local Technical Assistance Program)		X
MRUTC (Midwest Regional University Transportation Center – Madison, WI)	X	X
MTC & CTRE (Midwest Transportation Consortium & the Center for Transportation Research and Engineering – Ames, IA)	X	X
UC (University of Cincinnati – Cincinnati, OH)	X	
UTC (University of Illinois – Chicago, Urban Transportation Center – Chicago, IL)	X	
UTRC (CCNY University Transportation Research Center – New York, NY)	X	
International Organizations		
IRF (International Roads Federation)		X
PIARC (World Road Federation)		X

Course and Curriculum Development

Several educational groups are developing courses that introduce the Asset Management concept. Two University Transportation Centers actively developing Asset Management courses are the MTC and MRUTC (and their affiliated Universities). The MTC has developed several Asset Management related courses taught in Engineering, Planning, and Geography at Universities in Iowa, Missouri, and Pennsylvania. The MRUTC and Civil Engineering Departments at the University of Wisconsin and the University of Cincinnati have also developed courses on transportation infrastructure management. The Urban Transportation Center (UTC) at the University of Illinois – Chicago and the University Transportation Research Center (UTRC) at the City College of New York both offer courses in transportation infrastructure management. The UTC program focuses mainly in the engineering and planning aspects of Asset Management while the UTRC explores implementation and organizational change.

As many of these universities offer Asset Management coursework, some are also developing Master's degree programs in transportation management and policy. Groups working in this area are the University of Wisconsin, the University of Cincinnati, George Mason University and the University of Minnesota. At this time there are no Master's programs offered in Asset Management by any University. However, the University of Cincinnati is considering the feasibility of restructuring their Civil Engineering Department around the theory of Asset Management.

Finally, several other universities without a transportation research center, such as George Mason University and Lafayette College, are working on course development. These efforts are mainly developing courses in transportation and infrastructure management with a multi-disciplinary focus

that considers policy, planning, engineering, and organizational management skills. Lafayette is an undergraduate college, but has taken an active role in developing Asset Management curriculum and plans to hire a Professor in 2002 specifically in transportation infrastructure management.

Training

Several groups are developing training sessions to build the skills needed to implement Asset Management concepts. Groups such as AASHTO, APWA, and GASB have training efforts detailing the financial reporting requirements of GASB 34 and the options government has in demonstrating compliance with the new standards. Using the “modified approach” to report municipal capital assets under GASB 34 enables Departments of Transportation to quantify the value of their current network of roads, bridges, transit, etc. and funds spent to maintain them. Much of the guidance offered by groups like AASHTO, GASB, and APWA detail methods to value these assets and offer advice in how to adopt the modified approach.

Another significant effort in Asset Management related training takes place through national and state LTAP centers. Several state LTAP centers have roadway management related training seminars and conferences open to a nationwide audience. Some specific efforts are the Tenth Annual Roadway Management Conference in Virginia, Utah’s course on how to implement Asset Management principles (see Section 4: Implementing Institutional Change), several project management courses offered by the University of Wisconsin’s Engineering Professional Development program, and Iowa’s focus on GASB 34 compliance through CTRE and other educational organizations in the state. Many LTAP centers have training courses on pavement and bridge management and as Asset Management becomes widely recognized, the centers will be ideal places to share ideas and innovation.

Other groups with training efforts in Asset Management are FHWA, AASHTO and the Foundation for Pavement Preservation (FP²). These three groups and the National Highway Institute (NHI) are developing a course in Transportation Asset Management with a focus in implementing the AASHTO Guide to Asset Management (NCHRP Project SP20-24[11], scheduled for completion by Fall 2002). In addition, several courses in pavement performance and management (specifically, “Pavement Preservation: The Preventive Maintenance Concept”, “Pavement Preservation: Selecting Pavements for Preventive Maintenance”, and “Engineering Applications for Pavement Management Systems”) are currently available through NHI. Other NHI courses developed with a focus in Asset Management include a technical course on PONTIS 4.0 (a bridge management software program developed by Cambridge Systematics for the Office of Asset Management) and several courses in construction management.

Internationally, PIARC offers a variety of training courses on how to use HDM-4, a highway investment analysis program that is being used in many countries as they develop Asset Management systems. The International Road Federation (IRF) recognized the PIARC effort and discussed HDM-4 briefly at their Asset Management Seminar.

3. Research in Policy and Technical Issues in Asset Management

Developing Asset Management Policy

Several of the groups surveyed have research efforts in developing Asset Management policy. The AASHTO Task Force on Transportation Asset Management currently supports projects through the NCHRP and the TRB Asset Management Task Force is developing a research agenda. The MRUTC, MTC, and UTRC are the main educational institutions sponsoring policy research. Internationally, the Organization for Economic and Cooperative Development (OECD) has sponsored policy research in the past and developed a publication entitled, "Asset Management for the Roads Sector" which highlighted policies and technologies used for transportation infrastructure management in other countries.

The AASHTO Task Force Strategic Plan identified the importance of developing a Guide to Asset Management and initiated Project SP20-24[11] through NCHRP. Phase 1 of the Guide is complete with one section dedicated to developing a framework for implementation that relies upon goal setting and strategic planning. The report contains several recommendations on how to develop policy and the characteristics of good Asset Management policy.⁹ NCHRP is also sponsoring a review of GASB Statement 34 compliance in state Departments of Transportation (Project 19-04). This project is studying whether GASB 34, a policy in effect today, is achieving its desired effect of greater awareness and development of infrastructure management systems.

The TRB Task Force on Asset Management is developing a set of research needs in the area of Asset Management implementation. The Task Force is relatively young (formed in 2000) and has not formally initiated research projects with groups like NCHRP. However, they do place a priority on coordinating research with other TRB Committees and national groups to develop a clearer vision of required research needed to implement Asset Management, especially in institutional change.

The MRUTC and MTC have both sponsored research in Asset Management policy. The policy research efforts at the MRUTC focus on (1) developing a multi-objective decision-making framework to assist in complex decisions, (2) designing a guidebook that will outline a model process, guidelines, and performance metrics to develop Asset Management systems, and finally (3) the Asset Management experience in transit systems, inter-modal freight terminals, and long-

Research in the Policy Issues of Asset Management:

Professional Organizations:

- ☀ AAHSTO: Supports policy research through NCHRP. Projects include:
 - Asset Management Guide (Project SP20-24[11])
 - State DOT compliance with GASB 34 (Project 19-04)
- ☀ TRB: Developing a research agenda in Asset Management systems implementation.

Educational Efforts:

- ☀ Several research efforts at the MRUTC, MTC, and UTRC.

International Efforts:

- ☀ OECD: Researching the policies used in other countries to implement Asset Management.

Note: See the Acronym Directory for explanation of these acronyms.

⁹ Phase 1 of the Asset Management Guide (NCHRP Project SP20-24[11]) can be obtained through the NCHRP Products website at <http://www4.trb.org/trb/crp.nsf> (valid as of 03/06/02).

term ITS applications. The MTC has several policy-oriented research projects underway, including development of a local government Asset Management system manual and a model Asset Management strategic plan.

The UTRC sponsors research to assess how technological innovation influences the organizational structure and the transportation planning process in DOTs. Examples include studying the barriers to cooperation between public transportation agencies in New York and New Jersey and analyses of the impacts of federal urban transport policies including ISTEA and TEA-21. UTRC also studies the impacts of transportation policies and investments on economic development.

In a 2001 paper entitled, "Asset Management for the Roads Sector" OECD researched policies other countries are using to promote development of Asset Management systems. Overall, most of these systems are planning and policy intensive. As a result, there are several guidelines for infrastructure management as well as human resources, finances, risk, and heritage management. The purpose is somewhat similar to the NCHRP Asset Management Guide project, but developed as more of a survey of management planning over a wide area of interest.

Research in the Technical Issues of Asset Management

Several national groups sponsor technical research in the area of Asset Management. The National Cooperative Highway Research Program (NCHRP), several University Transportation Research Centers, and professional organizations including the Foundation for Pavement Preservation (FP²), ASCE & CERF, and ACPA all sponsor research efforts. Internationally, PIARC and IRF have also contributed to technical research by sponsoring a variety of projects.

The Asset Management Guide (NCHRP Project SP20-24[11]) will offer technical guidance on issues such as considerations in developing an economic modeling system, performance measurement, and methods to determine the value, economically and socially, of the transportation system. The Guide itself will package these tools and knowledge into one source of reference for State and local governments. This will be one of the most comprehensive sources of technical assistance supplied to the state and local level to date. Another technical project also recently funded by NCHRP will develop of suite of analytic tools to enhance the decision-making process (Project 20-57). The emphasis on this project is to develop a set of comprehensive engineering-economic analysis programs that maximize the benefit of a certain policy, which could be mobility, safety or preservation. It will be the first national program that has

Research in the Technical Issues of Asset Management:

- ✧ NCHRP: Several research efforts, including:
 - Asset Management Guide
 - Analytic Tools to support Asset Management
- ✧ MRUTC, MTC, and UTRC: Sponsoring a variety of studies in using technology to promote management systems
- ✧ FP²: Development of pavement preservation technologies and tools.
- ✧ ASCE/CERF: Testing of research products in the Highway Innovative Technology Evaluation Center (HITEC)
- ✧ ACPA: Developing remaining service life and life cycle costing models
- ✧ International Organizations: Efforts within PIARC and several Canadian organizations

Note: See the Acronym Directory for explanation of these acronyms.

attempted to model policies other than construction and maintenance. Another important goal of the Tools project is to incorporate trade-offs among other modes of transportation into the decision-making framework.

Each of the University transportation research centers mentioned in the policy section are also involved in technical research. These projects are typically quite specific in their application, but have the common theme of enhancing technology to make better decisions and manage transportation infrastructure more efficiently. Generally, the MTC sponsors research in GIS and other geographic data inventory systems that promote better management and decision-making tools. UTRC also sponsors a variety of technical research that considers regional transportation demands and how to optimize existing infrastructure. The MRUTC is supporting development of models for a multi-objective decision support tool and a transit resource allocation tool.

Several professional organizations, especially the Foundation for Pavement Preservation (FP²), ASCE, and ACPA, are sponsoring technical research efforts within their areas of specialization. FP², in partnership with FHWA, developed a research agenda in December 2001 centered on improved techniques for construction and preservation as well as prioritization, measurement and management of these needs. ASCE sponsors transportation research through the Civil Engineering Research Foundation (CERF), Highway Innovative Technology Evaluation Center (HITEC) which is an organization that evaluates innovative market-ready highway products before release. Most of the evaluations conducted are on bridge, pavement, traffic engineering, or maintenance technologies, but the organization is beginning to consider management programs and technologies as they are developed. A third professional association researching Asset Management technologies is the ACPA, which is developing a remaining service life model for integration into a life-cycle costing program. This research program is a partnership between ACPA and the Michigan DOT and will be available in 2002.

It is also important to note the efforts of several international organizations in technical research and innovation. As mentioned, PIARC has developed an economic investment model named HDM-4. Several Canadian efforts, mainly the Federation of Canadian Municipalities and the National Research Council of Canada, are researching management technologies currently used by provincial and local governments and will make recommendations for improvement in the National Guide to Sustainable Infrastructure. One product of the Guide will be an investment planning tool, which can be applied to all infrastructure assets and not just transportation. A second research effort just beginning in Canada is the Municipal Infrastructure Investment Planning (MIIP) project, which will complement the National Guide research with investigation of methods governments are currently using to manage assets and what techniques, such as service-life prediction and life-cycle economic modeling, they could be using more.

4. Implementing Institutional Change

The issues covered in Sections 2 and 3 (educational efforts and research in policy and technology) are by far the most researched areas of Asset Management. Much of this research circulates around *perceived* critical needs such as training in the theory of pavement management, development of investment planning software, or the implementation of roadway management policy. The need for these research efforts and the many others presented in this report are critical, but there is a gap discussing *how* to implement these innovations. It is one thing to

develop a new technology or policy in Asset Management, but another to implement and track how well it performs towards the greater goal of efficient transportation system management. This section details national groups that have recognized and researched the institutional change necessary to implement Asset Management systems. The groups found working in this area are the Local Technical Assistance Program (LTAP), the Federal Highway Administration (FHWA), and New York University's Rudin Center for Transportation Policy and Management.

The LTAP organization, and specifically the Utah LTAP group, has developed a core curriculum in Asset Management that goes beyond the classroom and into the workplace. After participants attend the technical training on specific concepts such as GASB Statement 34, data integration, or pavement management systems, the Utah group goes into the agency itself and assists managers and technical staff in adopting the new technologies and policies. The issues frequently encountered are more institutional and even personal as employees must change work habits and adapt to change. Because this is often a stressful transition for many, the strategy of the Utah group is to assist on specific Asset Management components instead of attempting to develop an entire system at once. Many agencies do not have the resources to develop full Asset Management systems and a more realistic approach is to phase-in the components (such as GASB Statement 34 management and accounting systems) and to encourage the individuals within the agency to develop a response. Individuals at LTAP, APWA, and FHWA hope this issue of "organic" awareness and implementation of Asset Management within local agencies will grow as national groups continue to provide assistance.

Institutional change was not the theme of a conference sponsored by the FHWA Office of Asset Management, but considered within the greater context of implementing pavement preservation practices. A 1998 effort entitled the "Forum on the Future" was co-sponsored by many organizations in the pavement management and construction industry as well as AASHTO, FP², and the National Highway Institute (NHI). The purpose of the Forum was mainly to explore needed technologies, policies, and studies to further the practice of pavement preservation.

A third group researching the institutional change necessary to implement Asset Management concepts was the Rudin Center for Transportation Policy and Management, a part of the NYU Wagner Graduate School of Public Service. The Center specializes in large city technical research exchange and it conducted a study of inter-jurisdictional coordination for traffic management. Several major cities currently use traffic management programs and the study focused on the development of these multi-agency systems and overcoming institutional barriers to achieve successful coordination. The study had two groups of findings: individual employee change and organizational change. On the employee side, the study found in-house staff expertise, face-to-face interaction, and ability for staff to move among agencies all invaluable in achieving the goal of better traffic management through collaboration. On the organizational side, some of most significant conclusions of the study were to address high-visibility collaboration problems from the outset, identify common interests between the agencies, proceed incrementally and in phases (much like the Utah LTAP Asset Management Course strategy), and find a leader who can champion the effort. More information on this study is available in the Appendix in the UTRC section.

CONCLUSIONS

Based on the results of this survey, the authors draw several conclusions on the level of awareness of Asset Management and current education and research gaps. Several of the organizations surveyed also identified research gaps. The authors and these national organizations find similar research needs, but several other areas of study are also proposed.

Introduction to Asset Management

An awareness of the concept of Asset Management exists in all the groups surveyed. Evidence of this awareness appears in presentations at annual meetings, publications on websites, and in interviews with individuals at each organization. However, the knowledge of Asset Management remains primarily within upper level management of these national organizations. It is a theory for discussion rather than a task-oriented strategy. Groups see value in the theory of Asset Management but many of them need to move into the implementation phase. Research and educational efforts should add insight into the needs of this next phase.

Educational and Research Efforts

The groups surveyed have the potential to contribute and share much research and education in Asset Management. However, groups recognize similar research gaps and often pursue parallel efforts. Not only is this inefficient but the overall study impact is minimal when they are pursued alone. Meetings where groups share applied research and educational efforts should be encouraged. Particular topics at these meetings could include institutional change and development of transportation infrastructure management Master degree programs.

Especially in the area of technical research, efforts must not replicate ongoing or previous work. In the management software area alone NCHRP, ACPA, and ASCE/CERF are all developing, testing, and/or improving programs. Sharing the results could avoid duplication of effort.

In addition, it is apparent that a large amount of technical research must occur to clarify the role of Asset Management and facilitate implementation. Most of the research identified in the survey raises issues that future research efforts will have to address. AASHTO, NCHRP, and other organizations providing resources for further technical study should acknowledge further technical needs.

The international survey of Asset Management efforts shows that another gap in current US research is considering how Asset Management can assimilate community goals, conservation, and sustainability into a decision-making framework. The Australian Procurement and Construction Council advocates for an Asset Management framework that addresses these concerns in tandem with the future engineering requirements of the system.¹⁰ They conclude the benefit of this comprehensive system is it assimilates these concerns into one framework instead

¹⁰ Australian Procurement and Construction Council (APCC), *Asset Management 2001* www.apcc.gov.au (valid as of: 02/20/2002).

of neglecting one or the other. This system is still in developmental stages in Australia, but should these same issues be a part of Asset Management discussion in the US? Several indicators in our funding predictions alone advocate for better community decision-making and conservation of transportation infrastructure. The US DOT, "1999 Status of the Nation's Highways, Bridges, and Transit: Conditions and Performance" reports \$94 billion/year will be needed over the next twenty years to improve just the roads and bridges on the federal network.¹¹ Considering this figure, an important question to consider is not just how to get this funding, but if there are ways to manage mobility and transportation needs more efficiently through conservation policies in an Asset Management system. The decision-making and tradeoff analyses in Asset Management systems can question how community, conservation, and sustainability goals influence the construction, maintenance, operations, and other requirements of the system.

National Research Agendas

Several of the groups surveyed have research agendas in policy, technology, planning, and education. The AAHSTO Task Force on Transportation Asset Management Strategic Plan, the TRB Asset Management Task Force August 2001 Research Agenda, and the Recommended Research Program section of the Asset Management Guide (Phase 1 of NCHRP Project SP20-24[11]) are among these. Other research agendas in transportation infrastructure management are the Infrastructure Renewal Research Agenda developed by the National Highway Research and Technology Partnership Forum and the results of a session entitled "Setting the Transportation Asset Management Research Agenda" at the MRUTC 2001 Transportation Asset Management Workshop.

Many of the needs raised by these five groups are similar. The discussions can roughly be categorized into four areas: (1) policy, (2) implementation, (3) technology and information management, and (4) education. Specific recommendations from these research agendas and this survey include, but are not limited to, the following:

- Development of tools and policies to facilitate implementation of Asset Management.
- Case studies that document the economic and social benefits of enhanced management techniques.
- Development of a multi-disciplinary educational program that focuses on the many aspects of transportation infrastructure management, including policy, engineering, and planning.

These areas of research are very timely considering the level of awareness of Asset Management in the organizations surveyed by this study. These products will also facilitate implementation of Asset Management systems.

Other Areas of Recommended Research

The authors of the study found a need for better communication between national groups as well as more research in effective communication. Best practice studies demonstrating effective communication and leadership in implementing an Asset Management program could yield significant insight for many national groups as well as state and local governments.

¹¹ US DOT, 1999 Status of the Nations Highways, Bridges, and Transit: Conditions and Performance, 2000.

In line with this topic, future research should also address institutional change and elaborate upon the internal alignment issues necessary to develop Asset Management programs. Often these are the hardest to address and not surprisingly the most difficult for government agencies to overcome. Investigating these areas or at least admitting they are significant concerns is an important issue to address. As Asset Management theories and systems evolve, the national efforts investigated in this report must recognize these needs and give them the same priority they give technical research today.

